

DOCUMENT RESUME

ED 151 153

SE 023 493

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TITLE Manpower Planning for the Wastewater Treatment Workforce of Texas: An Emerging Function. Presented at the Annual Meeting of the Texas Water Utilities Association (58th, College Station, Texas, March, 1976).
INSTITUTION Texas Water Quality Board, Austin.
PUB DATE 76
NOTE 19p.
EDRS PRICE MF-\$0.83 HC-\$1.67 Plus Postage.
DESCRIPTORS *Manpower Development; *Manpower Needs; Manpower Utilization; *Planning; Pollution; Speeches; *State Agencies; *Water Pollution Control; Water Resources
IDENTIFIERS *Texas; *Waste Water Treatment

ABSTRACT

This paper, presented at the 58th annual meeting of the Texas Water Utilities Association, attempts to point out the need for manpower planning for the wastewater treatment workforce of Texas. As reasons for manpower planning, this document discloses estimates of 1400-1500 new jobs, 1300 of which will be in wastewater treatment facilities of 1 MGD or more in Texas by the year 1980. In addition to increasing demand for operators and other trained personnel, there will be a substantial increase in needed training funds. Due to environmental regulations, it is necessary for local governments to meet these demands. This requires long range planning. This document reveals that the manpower planning efforts in Texas consist of a careful assessment of the present wastewater treatment workforce's movements into, through, and out of the field, careful staffing and training projections, and a computer housed data base of these assessments and projections. (MR)

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MANPOWER PLANNING FOR THE WASTEWATER TREATMENT WORKFORCE OF TEXAS: AN EMERGING FUNCTION

Presented at the 58th Annual Meeting of the Texas Water Utilities Association
March, 1976 College Station, Texas

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SE 023 493

ABSTRACT

The manpower planning staff of the Texas Water Quality Board's Environmental Education and Training Section has determined that by 1980, approximately 1400-1500 new jobs will be created due to the construction of new wastewater treatment facilities and/or the expansion and upgrading of existing facilities in the State of Texas. These staffing projections are based on the 340 construction projects currently managed by the Board's Construction Grant Section. Of these 340 projects, 156 are plants with design capacities of 1/MGD or more; 184 are plants with design capacities less than 1/MGD; 105 are plants involving advanced wastewater treatment. Of the total of 1400-1500 new jobs, approximately 1300 will be in the operation of wastewater treatment facilities with capacities of 1/MGD or more. Also, estimates indicate that approximately 700-1000 of the 1400-1500 new jobs will be created by those facilities using some form of advanced wastewater treatment.

In addition to increasing the demand for operators and other wastewater treatment personnel over the next few years, the above figures also indicate that a substantial increase in training funds will be needed. It is estimated that at least \$800,000 dollars will be needed to insure that competent and well-trained personnel fill these positions.

The Board's manpower planning staff is also actively engaged in examining the existing wastewater treatment workforce in an effort

to obtain data on manpower movements into, through, and out of the field. Data collected and analyzed for the existing workforce will be used with the staffing projections mentioned above to determine a total estimate of the number and types of personnel needed in the next few years by both existing and future wastewater treatment facilities. Present plans are for the staffing projections and data on the existing workforce to be linked together into a manpower data base which will be updated periodically and computer-housed.

The Board's manpower planning effort is aimed at helping local units of government meet their particular manpower needs for effective wastewater treatment as required by state and federal statutes. However, in order for the Board to achieve viable and effective manpower planning programs, it is necessary for local units of government to provide input as to what their needs are.

The Environmental Education and Training Section encourages anyone interested in manpower planning for wastewater treatment plants to contact us for any assistance that we might offer. The manpower data collected thus far or to be collected in the future is freely available upon request.

MANPOWER PLANNING FOR THE WASTEWATER TREATMENT WORKFORCE OF TEXAS:
AN EMERGING FUNCTION

by Tom Jackson

It is my pleasure to speak with you today about a new and emerging function in water quality management. This function is environmental manpower planning. It is appropriate that discussion of this subject should take place here at the Annual Texas Water Utilities Association Short School. This short school has a long history of providing one of the most innovative and progressive learning environments for water and wastewater utilities personnel in the entire nation. The free interchange of ideas which occurs here contributes greatly to the improvement of wastewater treatment across the state. Therefore, I feel at ease to present what has been done and what needs to be done in this important field of environmental manpower planning. The information and views I present are based on my experience in the water pollution control program.

The Texas Water Quality Board recognizes the importance of the quality and use of human resources to the attainment of its environmental objectives. The Texas Water Quality Board's Environmental Education and Training Section maintains a full-time manpower planner for the purpose of identifying and defining the needs of the wastewater treatment workforce of Texas. Top management of the U. S. Environmental Protection Agency also has become increasingly aware of the importance of ensuring that qualified manpower is available for environmental protection activities. It is the desire of the Texas Water Quality Board that the cooperative relationship which exists between the Board and the Environmental Protection Agency concerning

manpower planning be fostered and further developed. The objective of this relationship aims toward helping local units of government meet their particular manpower needs for effective wastewater treatment as required by state and federal statutes.

Recent federal legislation dealing with water pollution control has been very strict. P.L. 92-500 contains many comprehensive and coordinated plans for improving the quality of water across the nation. Billions of dollars are in the process of being granted to municipalities for the construction of new and better wastewater treatment plants capable of producing high quality effluents. Accompanying this increased number of new and better facilities must come the realization that adequate numbers of properly trained and qualified personnel are essential to operate and maintain these expensive facilities in a cost-effective manner. Incompetent and/or inadequate manpower would render the best treatment plant ineffective.

The ultimate manpower planning goal at the Texas Water Quality Board is to ensure that the wastewater utilities plant organization has the right number of the right type of people at the right times and at the right places doing things for which they are most useful. Also included in this process must be a concerted effort at the municipal level to ensure that each employee have the opportunity to continually develop and fully utilize his capabilities, have proper working conditions, and be properly rewarded for his efforts. We realize that this is an ambitious undertaking, but we firmly believe that it is a necessary activity towards ensuring that qualified and adequate manpower is available for those water pollution control activities mandated by law.

The first step in this manpower planning process consists of a comprehensive needs assessment of the numbers and types of staff needed by both existing and future wastewater treatment facilities. The collection of such information will serve as the basis for the development and maintenance of an ongoing, computer-housed manpower data base for the municipal wastewater treatment workforce of Texas. Hopefully, the information collected and analyzed for the municipal workforce will serve as the basis for expanding into the private sector. Once completed, this municipal manpower data base will provide the critical and quantifiable data necessary for the formulation and implementation of action plans needed to alleviate state manpower problems. Actions based on sketchy or superficial research usually fall short of solving the real problem or even worse create new problems. There can be no excuse for poor or no planning.

As of this date, the manpower planning staff of the Texas Water Quality Board's Education and Training Section has made considerable progress toward establishment of the above mentioned manpower data base. Quite recently a system was developed for forecasting manpower which will be needed due to the construction of new plants and/or the upgrading and expansion of existing plants. It has been determined that by 1980, approximately 1400-1500 new jobs will be created by these new or expanded wastewater treatment facilities. In addition to increasing the demand for operators and other wastewater treatment personnel, this figure also indicates that a substantial increase in training funds will be needed. A recent study completed by the Environmental Protection Agency estimated that the cost of training a single operator averaged \$565.00.¹ This means that over the next

five years, at least \$800,000 will be needed to ensure that the 1400-1500 future positions mentioned above are filled by competent and well-trained personnel. It should be noted that this estimate of training costs is entirely separate from the funds which will be needed to provide renewal, upgrade, and entry level training for the existing or current wastewater workforce.

The above staffing projections were obtained through extensive use of the construction grant files of the Texas Water Quality Board. After numerous discussions with the staff members of the Board's Construction Grant Section and careful examination of the various documents in the construction grant files, we determined that the facility plans offer the best staffing information available. The facility plan is a comprehensive study of the possible waste management alternatives for a proposed construction project. The purpose of the facility planning effort is to select that alternative which is the most cost-effective and environmentally sound. The facility plans are most valuable for manpower planning purposes in that they provide staffing projections at such an early stage in the construction grant process. Each project receiving grant monies is required by law to submit a facility plan at the end of step 1 of the construction grant process. This makes staffing projections available 2 to 5 years before the plant comes into full operation, depending upon the complexity of the project. The remaining two steps in the construction grant process include the preparation of plans and specifications and actual facility construction. Operation and maintenance manuals also contain staffing information. However, the staffing information is not of much assistance in making long-range projections due to the fact that these

manuals are submitted when facility construction is between 50 and 90% complete.

The research procedure followed in examining the facility plans consisted of the following steps. A current list of approved facility plans was obtained from the Board's engineers in the Construction Grant Section. Each project file containing an approved facility plan was examined and the appropriate staffing information recorded on a staffing projection worksheet. Sixty-eight facility plans which involved the construction of a new plant and/or the upgrading and expansion of an existing plant were researched. Projects which involved the construction of interceptors, collection systems, outfall lines, or lift stations were not included due to the negligible amount of additional manpower needed to operate and maintain most of these types of improvements. Out of the total of 87 current and approved facility plans, only 19 or 22% were of this type.

For each of the 68 facility plans which was researched, an attempt was made to record staffing projections in four basic categories or occupations: operators with a breakdown for each grade (A, B, C, D), supervisors, maintenance personnel, and laboratory technicians. However, most of the facility plans listed total personnel needed rather than a specific number for each occupation. These total personnel requirements are probably sufficient for projection purposes, due to the fact that over one-half of the 68 plans were for projects with design flows of less than 1 million gallons per day (MGD). The workload at these plants with small capacities is usually shared rather equally by all of the employees and thus a breakdown of manpower projections into specific occupations is not necessary.

Also obtained from the facility plans was information concerning the type of treatment for each new plant or plant expansion. Of prime concern here was the acquisition of data which would enable the manpower planner to gain some idea of the number of staff needed specifically by newly constructed and/or expanded advanced wastewater treatment facilities. Out of the 68 plans which were researched, 21 or 31% were for projects involving advanced wastewater treatment. In addition, the existing flow, design flow, design population of the area to be served, and projected date of completion was recorded for each project. This information was compiled and displayed on summary report forms in such a way as to indicate separately the manpower needed by new plants, upgraded or expanded plants, and advanced treatment plants. On all the report forms, the data is identified with its corresponding Texas Water Quality Board district in an effort to make the projections more meaningful.

The 68 facility plans which were examined served as the basis for estimating the 1400-1500 new jobs which will be created by the 444 total construction projects listed on the Texas Water Quality Board computer print-out entitled "Construction Grant Priority Ranking Process". Of the 444 total projects, 340 involve the construction of a new plant and/or the upgrading and expansion of an existing plant. The remaining 104 are projects dealing with collection systems, interceptors, outfall lines, or lift stations. As described earlier, these 104 projects were not included in the staffing projections process due to the negligible amount of additional personnel needed to operate and maintain most of these types of improvements. These 104 projects comprise 23% of the 444 total projects. It is interesting to note that this percentage is

almost the same as the 22½ figure obtained for the number of similar projects which were part of the total of 87 current and approved facility plans.

Manpower projections for the 340 projects were completed by applying complicated and detailed statistical procedures to the data obtained from the 68 facility plans. In an effort to obtain more accurate projections, the 68 facility plans were separated into two groups according to design flow in million gallons per day (MGD), those 1/MGD or above and those below 1/MGD. It was determined that of the 340 projects, 156 were for projects with design capacities of 1/MGD or more and 184 were for projects with design capacities of less than 1/MGD.

Initially, an attempt was made to project staffing needs by using the 68 facility plans as a whole. However, after careful examination of the extreme differences in design flow and staff requirements among the 68 plans, it was decided to separate the plans into two groups. It was determined that approximately 1300 of the 1400-1500 new jobs will be created by those facilities with design capacities of 1/MGD or above.

Manpower projections for advanced wastewater treatment plants were also completed. By using similar statistical procedures involved in the above calculations, it was estimated that of the 340 projects involving new plants and/or plant expansions or improvements, 105 are projects involving advanced wastewater treatment. It was projected that the number of new jobs that will be created by these advanced wastewater construction projects will be somewhere in the range of 700-1000. It is interesting to note that the lowest of these two ranges comprises approximately one-half of the total of 1400-1500 jobs that will be created by the 340 construction projects involving new

plants and/or plant expansions or improvements in the next five years. Due to the specialized and complex nature of training required for the operation and maintenance of advanced wastewater treatment facilities, it is quite possible that the cost of training personnel for the 1400-1500 future positions will be higher than the previously mentioned \$800,000.

The high degree of uncertainty over continued funding of each project makes it difficult to obtain precise figures, but the data obtained in this study represents a fairly accurate estimate of the manpower which will be needed by new or expanding wastewater treatment facilities in the next few years. However, it should be noted that the accuracy of these figures is dependent upon the researcher's assumption that the 68 facility plans which were researched (a 20% sample) are representative of the total number of 340 projects. At the time the research was conducted, these 68 plans represented the total number of current and approved facility plans involving new plants and/or plant expansions or improvements.

In order to keep this projection system up-to-date it will be necessary to periodically examine future facility plans as they are approved and certified by Texas Water Quality Board staff. As more facility plans are submitted and approved in future months, the reliability of the data base for making projections will improve. It will also be necessary to periodically check with the Texas Water Quality Board engineers responsible for final inspections to determine which plants have been completed and are "on line". The number of staff at these completed projects will then be subtracted from the total projected staff needed. Based on careful research of the variety of documents in the construction grant files, it is the judgment of the

Board's manpower planning staff that this system of using facility plans to make staffing projections provides tangible manpower data at the earliest possible date. The completion of the facility plan represents the first stage in the construction grant process in which the municipality is required to devote serious consideration to the proper staffing complement needed to operate and maintain the completed facility. Attempts at projecting staffing needs at an earlier time, without the aid of documented needs assessments by the municipalities involved, would most likely result in mere speculation.

There is evidence on the local level of the beginning of an increased awareness of the importance of manpower planning to successful water pollution control. One of the facility plans which was examined indicated a perceptive insight into the objectives of environmental manpower planning when it stated, "to obtain best possible results from a given system, it is very important that the plant be operated and managed by qualified and competent personnel."²

A great deal of literature which has been issued by the Environmental Protection Agency is available to individuals or organizations interested in manpower planning for wastewater treatment personnel. The following manpower planning aids are available upon request from the Environmental Protection Agency regional headquarters in Dallas.³ One of the best sources is entitled Manpower Planning for Wastewater Treatment Plants.⁴ This relatively short and very readable manual provides some very good background material on manpower planning. Also included is a workbook section which is easy to use and quite practical. Several aids are available for use in estimating manpower requirements for various types and sizes of wastewater treatment

facilities. One of the most concise and lucid guides for making estimates of manpower needed for various types of plants between the size range of 1 to 100 MGD is Estimating Costs and Manpower Requirements for Conventional Wastewater Treatment Facilities.⁵ This study is probably more popularly known by the consulting engineers who completed it, Black and Veatch. Another good source is Estimating Staffing for Municipal Wastewater Treatment Facilities.⁶ This publication contains comprehensive graphs for obtaining detailed estimates of man-hours required for both the operation and maintenance of many wastewater treatment processes. This study deals with plants between the size range of .5 to 25 MGD. An excellent sourcebook for obtaining staffing guidelines for plants with capacities less than 1/MGD is entitled Estimating Staffing and Cost Factors for Small Wastewater Treatment Plants Less Than 1/MGD, Part I.⁷ All of these sources can be quite useful, but sometimes additional help or explanation is needed. We at the Environmental Education and Training Section of the Texas Water Quality Board are available to assist anyone interested in any aspect of environmental manpower planning for wastewater treatment personnel. Any manpower data that we have is available upon request. We encourage you to make your needs known to us. Only through your input can more viable and effective manpower planning programs be designed and implemented.

The second major part of the development the manpower data base will consist of an examination of the existing municipal wastewater treatment workforce. Information collected and analyzed here will be used with the previous staffing projections discussed above to determine a total estimate of the numbers and types of personnel needed

in the next few years by both existing and future wastewater treatment facilities. We of the Environmental Education and Training Section are making steady progress toward completion of an initial examination of the existing workforce, and data should be forthcoming during this calendar year. Like the staffing projection system, data on the existing workforce will be updated periodically in an effort to provide relevant and accurate information. Present plans are for the staffing projection system and data on the existing workforce to be computer-housed, thus providing a truly usable manpower data base capable of responding promptly to requests for quantifiable data.

The first step in examination of the existing workforce will be to determine the total number of people employed in each occupation. Information on the numbers and types of personnel will be grouped into four major occupational categories: operators with a breakdown for each grade (A, B, C, D), supervisors, maintenance personnel, and laboratory technicians. Other data collected will consist of an analysis of the manpower movements into, through, and out of the existing workforce. Initially, a one-year time period will serve as the basis for making these determinations. For each of the above occupations, data will be collected on the number of separations, number of transfers, number of new hires, and recommended employment levels. Separations consist of the number of people leaving the workforce due to resignation, retirement, dismissal, or some other reason. New hires include those persons from the outside labor force entering the wastewater treatment workforce with no prior experience. Recommended employment levels are those staffing levels which are recommended but not required. In many cases actual employment levels are below recommended levels, thus

creating problems related to understaffing. Transfers are of two types, those out of an occupation and those into an occupation. Each of the occupations will gain some personnel due to transfers in from the other occupations, but will also lose some people due to transfers out. All of the manpower movements into, through, and out of the existing workforce will be displayed in diagrammatic form through use of an instrument called a manpower pipeline. As with the staffing projection system, manpower movements will be broken down into Texas Water Quality Board districts in an effort to make the data more meaningful.

Upon completion of the initial examination of the existing workforce, a total estimate of the numbers and types of staff needed by both existing and future wastewater treatment facilities can be determined. This will be done by first adding the number of separations and net transfers out occurring in each occupation during the initial one-year time period to obtain an estimate for the number of replacements needed by the existing workforce. These figures will then be used with the staffing projections for future facilities to determine a total need. Like the staffing projection system, update analyses of the existing workforce will be needed at appropriate intervals in order to provide the information necessary for estimating staffing needs further into the future.

Once developed, the manpower data base should serve as the basis for the formulation of action plans. With knowledge of numbers and types of personnel needed, recruiting and training programs can be formulated. By figuring the certificate expiration dates for existing certified personnel in each of the four occupational categories, an estimate can be obtained as to update or renewal training that will

be needed in the next few years. Also, the number of new hires and number of transfers to a higher position will provide information on entry and upgrade training needed. Determination of needs first is not only the most valid method for developing training plans and action steps, it is also the most cost-effective. Each year, many tax dollars which are spent on wastewater-related manpower programs fall short of achieving the maximum benefit possible because the real problem or need was not clearly identified before action was initiated.

Hopefully, the manpower data base will provide the impetus for the initiation of in-depth studies aimed at examining such things as the retention and utilization of wastewater treatment personnel. One of the most urgent existing needs is a manpower structure. This need has been recognized by the Environmental Protection Agency and a major part of the water quality management strategy for Federal Fiscal Year 1977 includes increased support and guidance for state manpower planning programs. Each job category of the wastewater treatment workforce of Texas should be outlined as to specific duties, educational qualifications, and job-related training requirements. Also included in this manpower structure should be the development of a career ladder which outlines and establishes the ports of entry and promotional opportunities for each job category. The development and implementation of this manpower structure will serve as the basis for a greater professional acceptance of wastewater treatment personnel. Hopefully, with this increased professional acceptance will come higher salaries resulting in less turnover and more effective wastewater treatment.

I think that the manpower data base which has been discussed here today will, when completed, provide the quantifiable data essential

to the development of a more comprehensive manpower planning function for the wastewater treatment workforce of Texas. It is my hope and expectation that environmental manpower planning will continue to grow to include the identification and solution of a wide range of problems confronting the many dedicated individuals engaged in this important aspect of environmental protection.

FOOTNOTES

- ¹Harbridge House, Inc., Effectiveness Evaluation of Operator Training Conducted Under the PSC Program (June, 1972) prepared for the U.S. Environmental Protection Agency, p. 58.
- ²City of Borger Sewer Improvement Facility Plan and Environmental Assessment, Book 1, p. 12.
- ³For copies of the mentioned publications, please address requests to: Office of Manpower Training, EPA Region VI, 1600 Patterson, Suite 1100, Dallas, Texas, 75201.
- ⁴Olympus Research Corporation, Manpower Planning for Wastewater Treatment Plants, prepared for the Office of Water Programs, U. S. Environmental Protection Agency.
- ⁵W. L. Patterson and R. F. Banker, Estimating Costs and Manpower Requirements for Conventional Wastewater Treatment Facilities (Kansas City, Missouri: Black and Veatch Consulting Engineers, October, 1971) prepared for the Office of Research and Monitoring, U. S. Environmental Protection Agency (Contract No. 14-12-462).
- ⁶Operation and Maintenance Program, Office of Water Program Operations, U. S. Environmental Protection Agency, Estimating Staffing for Municipal Wastewater Treatment Facilities (Washington, D.C., March, 1973), Contract No. 68-01-0328.
- ⁷E. Robert Baumann, et. al., Estimating Staffing and Cost Factors for Small Wastewater Treatment Plants Less than 1/MGD, Part I. Staffing Guidelines for Conventional Municipal Wastewater Treatment Plants Less Than 1/MGD (Iowa State University, Department of Industrial Engineering and Engineering Research Institute, June, 1973) prepared for the Manpower Development Staff, Office of Water Programs Operations, U. S. Environmental Protection Agency (Grant No. 5P2-WP-195-0452).